Name:\_\_\_Teacher Solutions\_\_\_\_ Date: Tuesday March 20 2012\_\_\_\_

1. In each of the following examples, identify the factor that affects the rate of the reaction

described;

(a) Gold and copper are both used in jewellery, but copper bracelets will turn green over time.

*Answer: Chemical Nature of the Reactants*

(b) Milk kept in a refrigerator will keep for a week or more, but milk left out on the counter will

quickly turn sour.

*Answer: Temperature*

(c) Papain is a food additive that is sometimes added to meat to make it more tender.

*Answer: Presence of A Catalyst*

(d) The dust from grain silos has been known to explode, whereas kernels of grain are almost

nonflammable.

*Answer: Surface Area.*

(e) Vinegar is safe to add to food and consume, but pure acetic acid will burn skin on contact.

*Answer: Concentration*

2. The reaction among permanganate, iron (II), and hydrogen ions occurs in aqueous solution as

follows:

MnO4-(aq) + 5 Fe2+(aq) + 8 H+(aq) Mn2+(aq) + 5 Fe3+(aq) + 4 H2O(l)

Given that the rate of this reaction is 4.0 x 10-2 mol/L MnO4-(aq) consumed per minute,

calculate and express the rate of reaction with respect to each of the other reactants or

products in the equation.

*Answer*

0.32 mol H+(aq)/(L•min)

0.040 mol Mn2+/(L•min)

0.20 mol Fe3+/(L•min)

0.16 mol H2O/(L•min)

3. Use the data from Table 14.3 to establish the order of reaction with respect to HgCl2 and

C2O42- and also the overall order of the reaction.

2 HgCl2 + C2O42- 2Cl- + 2 CO2 + Hg2Cl2

Table 14.3: The Kinetic data

|  |  |  |  |
| --- | --- | --- | --- |
| Experiment | [HgCl2], M | [C2O42-], M | Initial rate, M min-1 |
| 1 | 0.105 | 0.15 | 1.8 x 10-5 |
| 2 | 0.105 | 0.30 | 7.1 x 10-5 |
| 3 | 0.052 | 0.30 | 3.5 x 10-5 |

*Answer*

*Rate = k[HgCl2]m[C2O42-]n*

*m look at experiments 2, 3*

*concentration is doubled (0.052 -> 0.105) the rate doubles (3.5 -> 7)*

*m = 1*

*n look at experiments 1, 2*

*concentration is doubled (0.15 -> 0.30), the rate quadrupled (1.8 -> 7.1)*

*n = 2*

*overall reaction rate = 3*

4. The initial rate of the reaction A + B C + D is determined for different initial conditions,

with the results listed in the table.

(a) What is the order of reaction with respect to A and to B?

(b) What is the overall reaction order?

(c) What is the value of the rate constant, K?

|  |  |  |  |
| --- | --- | --- | --- |
| Experiment | [A], M | [B], M | Initial rate, M s-1 |
| 1 | 0.185 | 0.133 | 3.35 x 10-4 |
| 2 | 0.185 | 0.266 | 1.35 x 10-3 |
| 3 | 0.370 | 0.133 | 6.75 x 10-4 |
| 4 | 0.370 | 0.266 | 2.70 x 10-3 |

*Answer*

*a) Expt 1 and 3 – A is doubled; rate is increased by 2 -> first order*

*Expt 1 and 2 – B is doubled; rate is increased by 4 -> second order*

*b) Overall rate order = 1 + 2 = 3*

*c) Rate = \_3.5 x 10-4 M s-1\_= 0.102 M-2 s-1*

*(0.185 M)(0.133M)2*

5. Molecular iodine dissociates at 625 K with a first-order rate constant of 0.271 s-1. What is the

half-life of this reaction?

*Answer: t1/2 = \_0.693\_ = 2.56 s*

*0.271s-1*